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NASA TECH BRIEF

Progress in Research on Chlorate Candle Technology

Several deficiencies have been found in the sodium chlorate candles used to generate oxygen in emergency situations. An earlier standard candle composition (see Tech Brief 67-10095) contains sodium chlorate as the oxygen source, reduced-iron powder as the fuel, barium peroxide to suppress evolution of chlorine gas during decomposition of the chlorate, and glass fibers for added structural strength. The candle constituents obtained from commercial sources have been found to contain impurities which give rise to harmful gaseous contaminants in the evolved oxygen. Conventional candle igniters enclosed in the candle casing were found to be unreliable and also to produce various contaminants. Fabrication by the wet pressing method resulted in candles of undesirably low density and high residual water content. The alternate method of fabricating the candles, melt-casting in molds, is also unsatisfactory. The casting operation involves some hazard, as the melt reaches at least 260°C. Also, as the sodium chlorate is the only constituent of the candle to melt, settling of the solid materials may occur during cooling of the mold, resulting in nonuniform candle properties.

In view of the difficulties mentioned above, a research and development program was conducted to improve the candle formulation, production method, and igniter design. The following is a summary of the results achieved in this program. The use of cobalt in place of iron as a fuel for the candle is a promising development. This metal, by catalytic effect, lowers the decomposition temperature from 478° to 280°C. High-purity oxygen is liberated by candles containing commercially available cobalt of 99.9% purity. Of the several dry processing methods evaluated, hot extrusion and hydrostatic pressing show the greatest promise. The dry processing methods produce candles of much lower water content than those produced in previous wet processing methods. This is important as water enters into the reaction sequence that produces chlorine gas. Barium peroxide which has been previously used to suppress the evolution of chlorine is thus not required in the relatively dry candle. Additionally, barium peroxide can be replaced by an equivalent amount of sodium chlorate to raise the available oxygen content of the candle. More significantly, contaminant gases (carbon monoxide and carbon dioxide) derived from the barium carbonate contained in commercial barium peroxide are essentially eliminated from the oxygen product of the candle. A fully enclosed ignition device based on pyrotechnic heater concepts has been devised and partially developed. No gases are produced by this device.

Note:

Requests for further information may be directed to:
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Patent status:

Inquiries about obtaining rights for the commercial use of this invention may be made to NASA, Code GP, Washington, D.C. 20546.

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